# Additional Considerations for Widening a Bridge

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# Questions to ask ourselves (Overview)

- Obstacles to widening, observations to consider
  - Age and condition
  - Compatible structures
- Repairs
  - Structure and Preservation
- Costs
  - Comparisons to new construction

# Age and Condition

- Age of the original structure
  - Dynamic rule of thumb ~75 to 100 yr. design life.
  - Consider the "Return on investment" of widening an aging bridge.
    - How much service life will we receive?
    - What is the alternative?

# Age and Condition

- Condition of existing structure:
  - What kind of shape is our bridge in?
    - Do the substructure and superstructure have advanced damage?  Extensive damage may be unnoticed without a hands-on approach.
    - What is the wearing surface of the deck?
  - Quantify this decision with Condition Ratings, inspection reports
    - What is an acceptable limit?

**SUBSTRUCTURE (ITEM 60)**

Structure ID: 191030049509218 Inspection Date: 08/21/2019

***DO NOT DISCLOSE. THIS INFORMATION IS CONFIDENTIAL UNDER THE TEXAS HOMELAND SECURITY ACT & 23 U.S.C SECTION 409, SAFETY SENSITIVE INFORMATION.***

| Component | Description | Min. | Rating | Comment |
|---|---|---|---|---|
| Abutment Caps | | *0* | 7 | Abutment caps have minor spalling and delamination along the top. |
| Above Ground | | *0* | N | |
| Below Ground or Foundation | | *0* | 8 | |
| Backwalls & Wingwalls | | *0* | 8 | |
| Intermediate Supports: | | | | |
| Caps - Concrete | | - | 5 | Bent 3 cap has moderate to severe delamination throughout (see photo). Other interior caps have minor to moderate delamination and spalling at shear keys (see photo). |
| Caps - Steel | | - | N | |
| Caps - Timber | | - | N | |
| Above Ground - Concrete | | - | 7 | Columns have minor scaling with exposed but secure aggregate near the ground/water line. |
| Above Ground - Steel | | - | N | |
| Above Ground - Timber | | - | N | |
| Above Ground - Masonry | | - | N | |
| Below Ground or Foundation | | - | 8 | |
| Collision Protection System | | *5* | N | |
| Steel Protective Coating | | *6* | N | |
| **Overall Component Rating** | | | **5** | |

# Considerations - Superstructure

- Some structure types are not widen-friendly
  - Pan Girders, Slab spans, Tee beams all <u>can</u> be widened, but:
    - They possibly need complex widening plans and traffic control
    - They are all older designs (think about “End of life” timeframe, LR codes.)
    - Joint maintenance on pan girders and tee beams can reach “point of no return”

# Considerations - Substructure

- Certain bridge types (like the ones previously mentioned) have shorter spans, thus more bents.
  - More widened bents means larger footprint, potential for reduced hydraulic capacity
  - Substructures are susceptible to deterioration from chloride ingress.

# Repairs

- When we widen a bridge, we want to repair the original structure.
  - Why?
    - Justifying Investment in a widening requires a proper return. The original bridge now has the responsibility of lasting as long as its widened section.

## Repairs and preservation

- While heavy construction is occurring on the bridge, the opportunity to perform major structural repairs and strategic preservation presents itself.

- Big ticket items:
  - Concrete repair
  - Overlays
  - Penetrating surface treatment
  - Steel painting
  - Bearing replacements
  - Joint maintenance!

# Repairs and preservation

- Concrete repair:
  - Necessary for protecting reinforcing steel, extending the life of the bridge.
  - Repairs done right will last years, executing repairs in accordance with the Concrete Repair Manual and proper inspection are key to a successful repair.

# Repairs and preservation

- Overlays:
  - Creating a wearing surface for traffic, protecting the surface of a concrete deck.
    - Multi-layer polymer overlay (10-20 years) and polyester polymer overlay (20-30 years).
    - Consider replacing Asphalt with polymer overlays as it is less porous, and more cost effective over time (higher up front with reduced maintenance costs.)

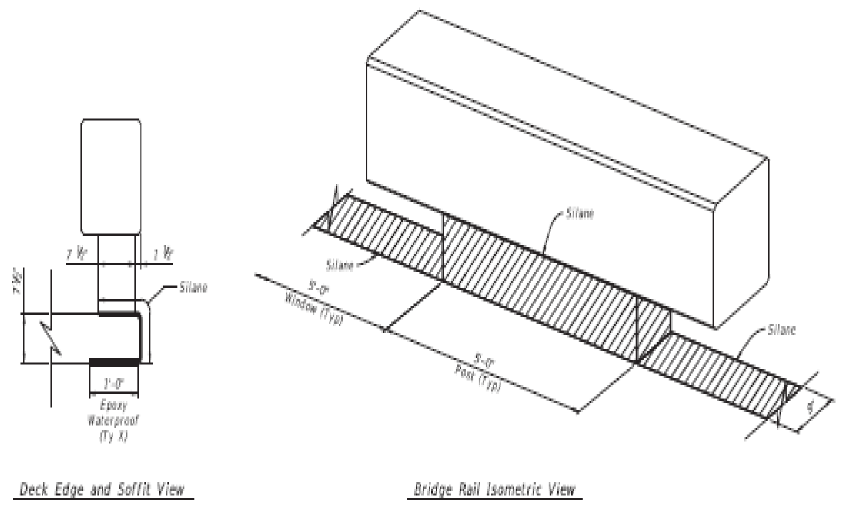
# Repairs and Preservation

- Silane!
  - Silane application creates an impermeable barrier within the concrete, preventing water and chlorides from penetrating to the reinforcing steel.

  - Silane must be re-applied every 5-10 years to be effective.

## Repairs and Preservation

- Silane to be applied at:
  - Concrete decks
  - Expansion joints, on bent caps
  - Overhang soffits, rail openings, soffits of deck drains
  - Anywhere you can expect water to go




DECK SURFACE TREATMENT DETAIL

# Repairs and Preservation

- Steel painting:
  - Properly painted steel lasts an incredibly long time.
  - Both reactive and proactive approaches
  - Zone painting focuses on critical points of bridge, such as joints, connections, areas of water exposure.

# Repairs and Preservation

- Bearing replacements:
  - Older bridges with bearing pads experience a wide variety of bearing issues
    - Pads being waltzed off the cap
    - “Squish”
  - Some older bridges used roofing felt as a friction surface
    - No force absorption
    - Thin enough that it’s hard to tell if anything is there

# Repairs and Preservation

- Joint maintenance, My experience:
  - Improper joint maintenance is responsible for the vast majority of bridge structural issues I have seen.
  - The two categories of issues I have seen stemming from joint maintenance:
    - Water
    - Expansion

# Repairs and Preservation

- Water
  - Joints that aren't sealed properly allow seepage, even storage of water on structure.
    - This potentially can wreak havoc on your immediate bents under joints, and doesn't stop there.
    - Water will travel across girders, down piers and will even pond on caps.

# Repairs and Preservation

- Expansion
  - Neglected joints will allow particulates to get in between spans.
    - With no room to expand, spans will ruin bearings, begin to crush backwalls.
    - End diaphragms store soil like a flowerpot, and can eventually push spans off of a bent.

# Costs

- Comparing costs of rehabilitation and new construction may help you decide whether to widen or replace.
  - Consider an “Average Lowest Bid” to be a historical document moreover than a pinpoint cost measure.
  - Quantities are important, large construction works will include an “economy of scale” factor.

# Costs continued

- The idea here is to contemplate the cost differences between new construction and widening.

- From a very short glance, it appears that widening costs can be up to 2X that of replacing an existing structure.

# Costs continued

- Widening requires partial demo, updating rails etc.

- Traffic control is a huge factor of any operations on a bridge:
  - Closures will be limited to minimize public impact
  - Traffic control requires resources
  - Capitalize upon closure time to complete what we can

# In summary

- To conclude:
  - Many considerations to be made before making this decision
  - We are stewards of the Taxpayer’s money. Consider it as an investment of the state.
  - ~~“Can we widen this bridge?”~~
  - “Should we widen this bridge?”

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Bridge Division – Construction and Maintenance

# Thank you.

Elk on road, Rocky Mountain National Park, CO →